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PROGRAM ANALYSIS
CARBONDALE BRANCH STATION

by

Richard D. Lane

CENTRAL STATES
FOREST EXPERIMENT STATION
Columbus 15, Ohio

Harold L. Mitchell, Director

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PROGRAM ANALYSIS

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CENTRAL STATES FOREST EXPERIMENT STATION

BY

RICHARD D. LANE, OFFICER IN CHARGE

SEPTEMBER 1947

FOREWORD

Immediately after the establishment of the Carbondale Branch of the Central States Forest Experiment Station, the local staff undertook a systematic "size-up" of the Branch Station territory and its short-term and long-term forest problems. From this analysis a research program was developed. Urgent problems were given first priority.

The following Program Analysis describes the Branch Station territory, lists the principal forest problems to which research can provide an answer, assigns priorities, and presents plans for an orderly attack on the most pressing problems.

Our plans were developed in close cooperation with local conservation interests to eliminate duplication and to provide for a maximum of correlation with existing forest research programs. These plans have been reviewed and approved by our Branch Station Advisory Committee made up of local leaders in forestry and allied fields.

We are distributing this Program Analysis among local foresters and conservationists to keep them posted on our plans, and trust that we will continue to receive their constructive suggestions for improving our approach to the solution of common problems.

HAROLD L. MITCHELL
Director
Central States Forest Experiment Station

Columbus, Ohio February 1948

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INTRODUCTION

This program analysis is a necessary first step in the systematic development of a forest research program specifically adapted to the needs of the territory served by the Carbondale Branch of the Central States Forest Experiment Station. In this analysis an effort was made to determine the present and potential role of forests and forestry in the territory, to evaluate the status of forest practices and to enumerate and classify the technical problems which must be solved to remove obstacles to the progress of forestry. This analysis also includes a proposed program of research, planning, and improvement work to be undertaken during 1947 and 1948. In developing this program the most pressing technical problems received first consideration. Other factors considered in assigning work priority were program and plans of other agencies conducting forest research within the territory; limitations of personnel, finances, and physical plant; and previous policy decisions and commitments.

TERRITORY SERVED BY CARBONDALE BRANCH

The territory served by the Carbondale Branch or research center includes the State of Illinois, excepting four counties in the northwest portion, and includes certain comparable forest areas in the adjacent States of Indiana, Kentucky, and Missouri. The boundaries of this 42 million acre territory or province are shown on page 3. In providing for this research center, Congress, except for mentioning the Kaskaskia Experimental Forest, did not indicate the headquarters or define the province to be served. The basic policies and procedures outlined in the long-range research center development plan proposed by the Forest Service, and approved by the 79th Congress, were followed in locating the province boundaries and in organizing and planning the research program.

IMPORTANT FEATURES OF RESEARCH CENTER ORGANIZATION

An important feature of the work center pattern of organization, which has proven so successful in the South, is on-the-ground concentration of effort on problems common to a distinctive forest region regardless of state lines or other political subdivisions. Included, therefore, are those sections of states adjacent to Illinois which are similar with respect to major forest types, forest problems, soil and physiographic features, size and type of forest ownerships and other features. Excluded are areas, such as the four

counties of northwestern Illinois, which are more similar to provinces served by research centers operating in or planned for adjacent states. Although not entirely homogeneous, the research center province represents a fairly distinctive section of the central hardwood region.

A clear understanding of this pattern of forest research organization is essential in planning research programs. For example, research center funds are not specifically earmarked by Congress for use in economic studies, regeneration, silvics, silviculture, utilization, mensuration, or other fields of forest research. Thus, there is comparative freedom from the curse of functionalism, making possible a well-rounded attack on the major forest problems of the province served.

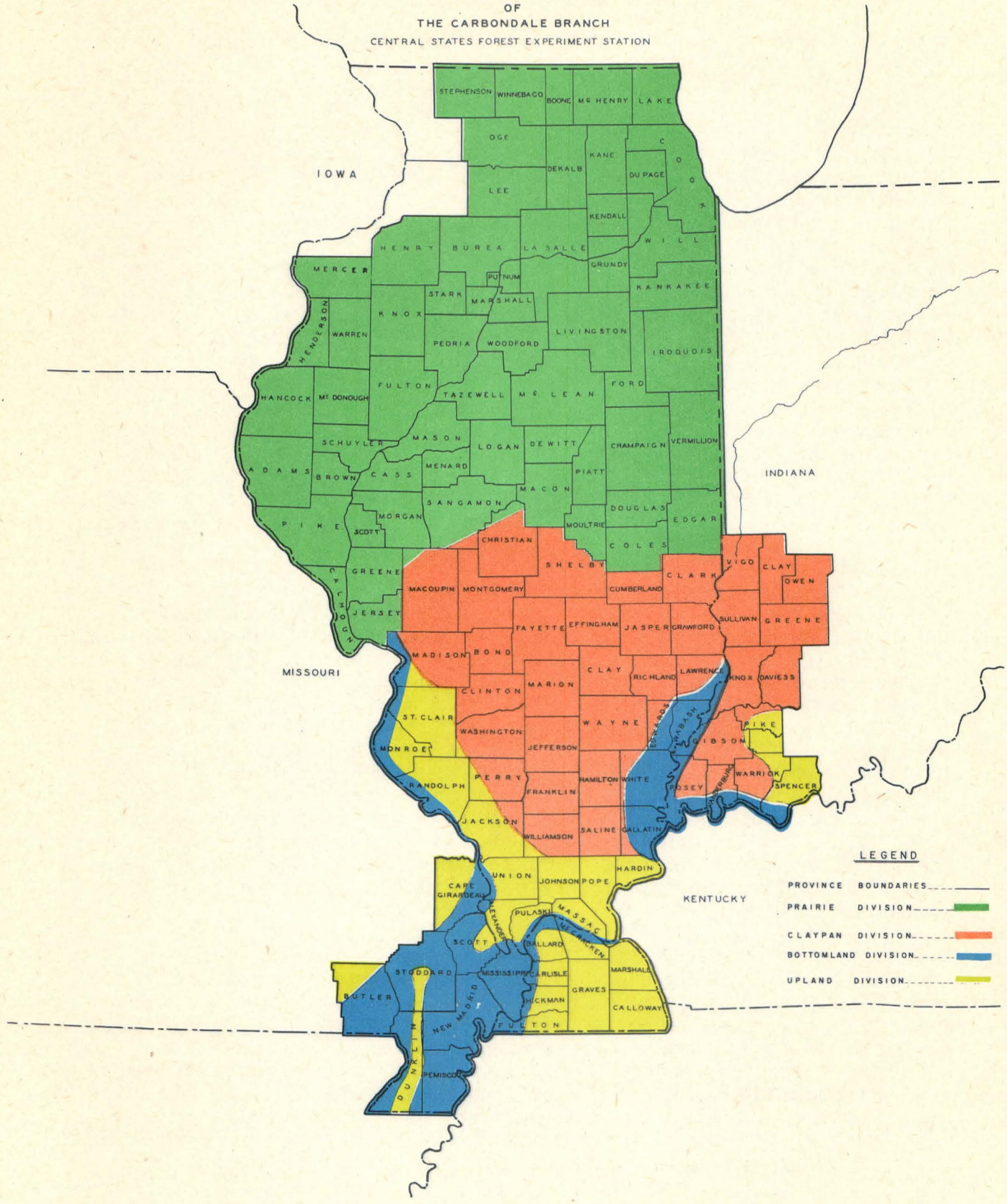
The only restriction is a matter of emphasis. For example, in sections of the country where forest grazing is an important source of income, range and timber must receive approximately equal attention. Or, if watershed protection is very much in the picture, water values are to be considered on a par with timber. Otherwise there is complete freedom to follow any line of investigation essential to the solution of the major problems of the province. For Carbondale, timber is to receive major emphasis.

Another important feature of the research center set-up is the opportunity for cooperation with local timberland owners, forest industries, state and other federal agencies. Problems of mutual interest, which are best solved by a joint approach, may be attacked, on a cooperative basis. Formal over-all cooperative agreements can be entered into with other forestry agencies operating in the province, and with timberland owners and wood-using industries interested in, and in a position to conduct, cooperative research. The research center program is to be geared to and fully integrated with, all forest research in progress or planned by other agencies. Research center units will not duplicate work undertaken or planned in fields adequately covered by others.

To insure development of a research program geared to local needs and fully integrated with programs of other agencies and groups, an Advisory Committee has been organized. This Committee is composed of representatives from state, federal and private agencies and organizations having forestry interests and from forest industries and forest land owners. Such a committee can help in many ways, especially by providing a background of local experience in forestry and related fields. They should also aid in directing attention to problems and conditions which might otherwise be overlooked.

PROVINCE AND DIVISIONS OF THE CARBONDALE BRANCH

CENTRAL STATES FOREST EXPERIMENT STATION



DESCRIPTION OF PROVINCE

In a province of 42 million acres there are certain differences, many of them of minor importance, which must be given consideration in planning a research program. For this reason the province has been divided into four relatively homogeneous subdivisions. Easily recognized physical features having the greatest influence on land use, especially for forest growth, were the basis for delineating the following divisions: (1) Prairie, (2) Claypan, (3) Bottomland and (4) Upland. Boundaries of these divisions are shown on page 10.

The Prairie Division was covered with a mantle of material transported by the Wisconsin and Illinoisan Glaciers. Most of the soils of this Division developed under prairie vegetation. A considerable area of gray-brown podzolic soils between the Mississippi and the Illinois Rivers, however, developed under hardwood forests. These soils are the youngest in the province, and leaching of soluable materials has not progressed to any great extent. Except for the hilly sections along the major streams and for moraines and residual hills, the topography is gently undulating to level. Many terminal moraines and residual hills are found along the southern edge of the Division, marking the terminus of the Wisconsin Glacier.

The Claypan Division is roughly the area of earliest glaciation in the province. Orginally this area was very flat. During the period following glaciation erosion, weathering, and leaching altered the soil character. Subsequent deposition of loess (wind-blown material) on both the eroded and uneroded surface plus continued leaching and weathering has produced a complicated soil profile. On the upland flats of this Division the soils developed under grasses. Where the flats gave way to slopes and on other better-drained areas, the soils developed under hardwood forests. The interior of the Division is level to gently rolling, except for limited areas along the streams. The margins break into the loessal bluff along the Mississippi and Wabash Rivers and into the Ozark Uplift along the southern margin. Along the eastern border this Division gives way to the unglaciated section of southern Indiana.

The Bottomland Division includes alluvial lands adjacent to the Mississippi, Wabash and Ohio Rivers and their tributaries. Practically all soils of this Division developed under a hardwood forest. They are, however, extremely varied because of differences in the method of transportation and deposition. They range from the most fertile soils of the province to relative unproductive areas of sand and clay. All of this Division is relatively level. The bottomlands of southeast Missouri, for example, do not have more than a 50-foot range in elevation. Thus, many of the soils must be drained before they can be

successfully cultivated.

In the main the Upland Division is covered with a mantle of wind-blown material. The principal exceptions are portions of Pike, Spencer and Warrick Counties of Indiana and Cape Girardeau and Butler Counties of Missouri. The bluffs along the Mississippi River overlooking the bottomlands are generally steep, well-dissected and have a deep layer of loess. In the unglaciated Ozark Uplift area in southern Illinois the loessal cap has eroded off in spots, leaving a mixture of residual and wind-blown material. Steep bluffs similar to those in the northwestern part of the Division, occur along the Mississippi River in Kentucky. To the east these give way to a rolling topography. Crowley's Ridge and the Commerce Hills in southeast Missouri are steep, well-dissected, loessal hills like those along the Mississippi in Illinois. On the steep, well-drained slopes and coves the soils developed under hardwood forests. Soils of the upland flats and poorly drained areas developed under prairie grasses.

INDUSTRY

In recent years the State of Illinois has ranked third in the United States in value of all manufactured products. The manufacturing centers of the research center province, including the secondary wood-using industries which are discussed in detail elsewhere in this analysis, are chiefly centered in the Prairie Division. In 1939, for example, Cook County's manufactured products had more than twice the value of products manufactured by all other Illinois counties.

Few important manufacturing centers are found in the other three divisions, where most manufacturing plants are small and are scattered among the smaller towns and villages. The coal and oil fields of the province are concentrated in the Claypan Division. These industries, with their accompanying transportation lines and supply houses, provide most off-the-farm employment in this Division.

AGRICULTURE AND LAND USE TRENDS

The Prairie Division of the province is one of the richest agricultural areas of the United States. It is characterized by neat, well-kept farm buildings, modern mechanical farming equipment and good farm management. The Division is endowed with easily cultivated, fertile, well-drained soils which do not require the intensity of soil building practices that is needed in the other divisions to maintain or improve productivity.

The average size of farm is 100 to 200 acres. The trend is toward a reduction in number of farms under 50 acres and an increase in the number of larger farm units. During the last thirty years land has been withdrawn from cultivation to build roads and highways, to expand urban sites and to develop recreational areas. The demand for grain, food crops, and livestock created by war conditions has been responsible for recent increases in the area of land under cultivation in the Prairie Division. These increases have largely resulted from land clearing and to a limited extent from the plowing of unimproved pasture. The desire for more tillable land has even led to removal of many of the hedge fences in the Division. Future world and national economic conditions may reverse or at least halt this trend.

Successful farming in the Claypan Division requires more intensive soil-building practices to improve and maintain productivity than are needed in the Prairie Division. In general, the soil is acid, less productive than those to the north, poorly drained in the level areas, and easily eroded in the rolling areas. This is particularly true in the southern portion of the Division. As a consequence, only a little more than one-half of the land is devoted to cultivated crops.

The trend is toward larger farm units but much of the area is still divided into small subsistence farms. Many of the owners work part or full time in the numerous coal or oil fields and in the small, local manufacturing plants.

In the past few years several of the coal and oil companies have purchased or leased land for shaft mining, strip mining, and drilling. Much of this land is now out of crop production. Some of the companies, particularly in the coal industry, have shown interest in establishing forest plantations on their lands or in managing their existing timber lands.

With proper fertilizing, liming, draining and cropping, the soils of the Claypan Division can be made to produce good yields. When handled in this manner, it is believed that they will provide a greater net return, in terms of interest on investment, than many of the richer agricultural areas of the province because of the relatively low cost of the land. These soils make an attractive investment when put in improved pasture. Also, fruit and berry culture has proven profitable in some parts of the Division. Forests must compete successfully with these land uses if extensive private forest plantations are to be established on marginal cropland.

Soils of the Bottomland Division are variable in productivity, ranging from rich black silts and loams to sandy, droughty areas within relatively short distances. Soils of the older river deposits, particularly in southeastern Missouri and

western Kentucky are frequently poor, white, "crawfishy" clay. With respect to the importance of agriculture this Division is second only to the Prairie Division. The better soils require little treatment except drainage for improvement or maintenance of productivity. In addition to drainage, the poorer clay soils of agricultural quality need lime, fertilizer and the proper crop rotation to raise their productivity. The sandy areas can be made more productive by the addition of organic matter and fertilizer, and by growing crops, such as grasses, which will protect them from wind erosion. Many of the farms in this Division are subject to overflow damage, and loss of one or two crops every five years is not uncommon.

Originally, the Bottomland Division was practically all in forest. Large blocks of these timberlands--several thousand acres each--were purchased by land and lumber companies during the early part of the twentieth century. As the timber was removed, the land was cleared, drainage districts established, and large farm units developed. During recent years some of these have been divided into smaller parcels and sold to share croppers and others. The general trend is therefore toward elimination of the forest and development of the land for agriculture. Recently, a few of the larger companies have recognized the value of good forest management and the high growth potential of the bottomland forests. They are now holding their overflow lands for this use and are attempting to purchase additional similar areas.

Soils of the Upland Division are derived from wind-blown parent material and were largely developed under hardwood forests. Their character and the rough topography prohibit intensive agriculture except in small local areas. The fruit and vegetable producing section of southwestern Illinois probably represents the most prosperous agriculture in the Division. Although agriculture is the leading industry, less than two-thirds of the land is cultivated.

Most of the farms are small and of the subsistence type but there is a definite trend toward larger farm units. Several of the owners depend upon mining of flourspar and other minerals, and still a larger number upon small local manufacturing plants for part- or full-time employment. Clearing of steep slopes for cultivation is still a common practice. Soil erosion is a serious problem throughout the Division. It is particularly acute in western Kentucky, the Commerce Hills and Crowley's Ridge of Missouri and on the steep loessal bluffs along the Mississippi River.

The striking contrast between the rich soils of the Prairie Division and those of the Claypan and Upland Divisions is made apparent by statistics published by the Illinois Agricultural Experiment Station. They show that 100 acres of untreated

cornbelt soils will produce the same specified yield as 600 to 700 acres of untreated soils in southern Illinois. The size, value, and gross income of the average farm in the Prairie Division greatly exceeds that of the Claypan and Upland Divisions and surpasses that of the Bottomland Division.

Commendable progress has been made in developing land-use plans, in better farming practices, in controlling erosion, and in improving forest practices. However, much remains to be accomplished throughout the province.

SOCIO-ECONOMIC CONDITIONS

As indicated in the preceding sections on Industry, and Agriculture and Land Use Trends, the Prairie Division is more nearly economically self-sufficient than the other divisions. In Illinois the Upland Division receives the greatest amount of public aid, the Prairie Division the lowest, and the two remaining divisions are intermediate in this respect. In 1939 more than 25 percent of the population in the Upland counties of southern Illinois were receiving public aid. As late as 1946, 10 to 15 percent of the population in seven of the 16 southernmost counties of Illinois was receiving public assistance. During the same year only two of the remaining 86 counties of the state had more than 7 percent of their population on public aid. As recently as June 1947, unemployment was reported to be a serious economic problem in the Claypan and Upland Divisions of Illinois.

The unfavorable socio-economic conditions in the Claypan and Upland Divisions are further exhibited by the losses in population from 1940 to 1943. Many of the Illinois counties in these two divisions lost from 15 to 30 percent of their inhabitants. During the same period practically all of the counties in the Prairie Division lost less than 15 percent of their population.

FOREST TYPES, LANDS, OWNERSHIP, CONDITIONS AND INDUSTRY

Forest Types

The eastern part of the Prairie Division, as well as the glacial till areas in the western and southern portions, are generally treeless. Forests have developed where larger streams have cut through moraines, in sheltered ravines, on well-drained slopes, and in depressions.

In the northeastern part of the Division burr oak, northern red

oak, and linden are the most conspicious species. Relic colonies of tamarack and arbor vitae may be found in the numerous lakes, bogs and springs of Lake and McHenry Counties. Farther south beech, maple, tulip poplar, oaks and hickories are common. The sand plains and sandy river flats of the Division support stands of black oak, pin oak, and black birch. On the better bottomlands mixed hardwood stands of soft maple, elm, willow, birch, pin oak, ash and cottonwood are common.

On the uneroded flats of the Claypan Division post oak, pin oak, shingle oak, and black birch are common together with other species usually found on poorly drained sites. On the slopes of streams and valleys where drainage conditions are much improved, mixed hardwood forests of white, black, red, and burr oaks, hickories, walnut, and elm abound. Occasionally black gum, sweet gum, hard maple, and tulip poplar are found in these stands.

In the Bottomlands a wide variety of forest types and species are encountered because the alluvial soils exhibit a wide range of drainage and productivity. Small areas of cypress and tupelo are still found in the swamps along the Mississippi and Ohio Rivers. Mixed bottomland hardwoods composed of cottonwood, elm, sycamore, red gum, many oaks, hickory, pecan, hackberry, and others dominate the stands now remaining in the Division.

Both dry site and moist site hardwood forests occur in the loess-covered hills of the Upland Division. Species common in other divisions are also well represented here. The drier ridge tops and south and west slopes support oaks and hickories. A few patches of shortleaf pine are found on these sites in southwestern Illinois. The moister coves and north and east slopes support oaks and hickories as well as hard maple, beech, black and red gum, and tulip poplar.

Forest Lands

Table 1 shows the total land area of the province by divisions and certain kinds of land use. A few summary percentages are shown. Many others can be calculated from the given acreages. Some of the more important of these appear in the text.

The present forest area plus the area of marginal and submarginal agricultural land that may eventually reforest naturally or through planting is estimated to be 12.7 million acres or 30 percent of the total land area. About 38 percent of this present and prospective forest area is in the Claypan Division and 14 percent in the Bottomland Division. The remainder is almost equally divided between the other two

Table 1.--Present forest area and prospective additional forest area by Province Division [1/]

Land Class	Division				Total	
	Prairie	Claypan	Bottomland	Upland		
	M acres	M acres	M acres	M acres	M acres	Percent
Present forest area:						
Farm woodland	1,361	1,327	761	1,105	4,554	11
Non-farm woodland	28	115	114	353	610	1
Total	1,389	1,442	875	1,458	5,164	12
Prospective additional forest area [2/]	1,932	3,333	882	1,409	7,556	18
Total present and prospective forest area	3,321	4,775	1,757	2,867	12,720	30
Non-forest and non-prospective forest area [3/]	18,952	5,942	3,321	1,472	29,687	70
Total land area	22,273	10,717	5,078	4,339	42,407	100

1/ Compiled from, "A Plan for Forestry in Illinois," July 1947, and from state and federal statistics.

2/ Data based upon productivity ratings of soil types established by Illinois Soil Survey and compiled by Department of Forestry, Illinois Agricultural Experiment Station.

3/ Total land area expected to remain in agricultural use, urban areas, highways, etc.

divisions. Approximately 40 percent of the 12.7 million acres of the present and prospective forest area is now in forest.

About one-third of the Upland Division is now in forest and approximately an equal area is submarginal and marginal agricultural land. Thus, this Division eventually may have almost two-thirds of its total land area in forests. The Claypan Division is second in this respect with 44 percent, the Bottomland Division is third with 35 percent and the Prairie Division last with only 15 percent.

As may be seen in Table 1 the estimated present forest land and prospective additional forest land area in the Prairie Division is 1,389,000 acres and 1,932,000 acres respectively. The trend away from forests in this Division has been mentioned previously, as was also the intensive agricultural use of the soil. We do not have adequate criteria for determining the highest use for land. In the light of present knowledge, however, we probably cannot justify, on a purely economic basis, the use of this much land for forests. Thus, we may expect either a continued reduction in forest area or a nearly static forest acreage. On this same basis we may logically ask if the 1,932,000 acres of submarginal and marginal agricultural land is actually better suited to forestry than some other use? Even if we assumed that most of it is, can we believe that in a free economy private ownership will put it to this use in the foreseeable future? Much the same situation, but to a somewhat lesser degree, exists in the Claypan Division which has 1,442,000 acres of forest and 3,333,000 acres of submarginal and marginal agricultural land.

The current trend in the Bottomland and Upland Divisions is toward more forest land. From the standpoint of highest land use, the bulk of the marginal and submarginal agricultural area in these Divisions is probably better adapted to forest production than to conventional agricultural crops. In fact, much of this area will naturally revert to forest through abandonment and overflow.

Forest Ownership

Farm woodlands comprise 88 percent of the forest land in the province, and total 4.5 million acres. Approximately 98 percent of the forests in the Prairie Division are in farm woodlands. The Claypan and Bottomland Divisions are intermediate with 92 and 87 percent respectively and about 76 percent of the Upland Division forests are in farm woodlands. If the area of State Forests, Parks and Game Preserves and the Shawnee National Forest is deducted from the total forested area of the Upland Division, about 90 percent of the remaining forests are in farm woodlands.

For Illinois, the average farm woodland probably is between 35 and 45 acres in size. Farm woodlands of the Prairie Division, except those on rougher areas and bottomlands, are probably smaller in size than those in the other divisions. This is particularly true in the eastern and central sections of the Prairie Division. Farm woodlands of the Claypan Division are intermediate in size, and those of the two remaining divisions probably have the largest acreage per farm.

As shown in Table 1, 610,000 acres of the forest land in the province is non-farm woodland. Nearly all of this is located in the Bottomland, Claypan and Upland Divisions. The Shawnee National Forest in extreme southern Illinois includes approximately 200,000 acres. A number of state forests and parks and state and federal game preserves, as well as U. S. Engineer lands are located in these three divisions. In Illinois, estate and industrial forests occupy only about two percent of the total forest land.

Growth, Drain and Operable Volume

The estimated forest growth, forest products drain, deficit and operable volume for the province and each of its divisions are shown in Table 2. Forest growth for the province was estimated at 830 million board feet in 1945. Total forest products drain for the same period was estimated at 1,040 million board feet, leaving a province deficit of 210 million board feet. The greatest deficit, 92 million board feet, occurred in the Upland Division. The Bottomland Division was second with a deficit of 63 million board feet, and the Claypan and Prairie Divisions were third and fourth, respectively, with deficits of 39 and 16 million board feet.

Table 2.--Estimated forest growth, forest products drain, deficit, and operable volume, by province divisions, 1945 1/

(In million feet, board measure)

Province Division	Forest Growth	Forest Products Drain	Deficit	Operable Volume
Prairie	140	156	16	4,100
Claypan	290	329	39	3,900
Bottomland	220	283	63	3,300
Upland	180	272	92	2,600
Total	830	1,040	210	13,900

1/ Derived from Forest Resource Appraisal, 1945, and Bureau of Census Reports, 1942.

The total operable stand for the province was estimated at 13,900 million board feet. Approximately 30 percent of this

volume is located in the Prairie Division. The Claypan and Bottomland Divisions have 28 and 23 percent of the volume respectively, while the Upland Division has only 19 percent.

Forest Practices

Improper cutting practices, grazing, and burning have left the woodlands of the province badly understocked, and without an adequate distribution of age classes. As a consequence, they are now yielding less than one-half of the volume possible under good protection and sustained yield management.

It is estimated that, for the province, less than one farmer in twenty manages his woodland in conformity with good forestry principles. Very little stand improvement work, such as thinning, pruning, and other intermediate cuttings, is being done on privately-owned woodlands. More than one-half of the woodland area is grazed to some extent. Twenty-three percent is grazed so heavily that its existence is threatened. Productivity is greatly reduced on an additional 18 percent, and only 13 percent is lightly grazed. Approximately 70 percent of the woodland area in northern Illinois is pastured and only 39 percent is grazed in the southern part of the state. Less than half of the forest land in the entire province is now under organized fire protection, and about one-third shows some evidence of past fire.

Almost nine-tenths of the forest land in the province is on farms. These woodlands are scattered in small patches on 70,000 to 80,000 farms. Few farmers or other private owners realize that their forests will yield a perpetual crop and a constant return if given proper protection and management. Only a few of these owners who are interested in forestry, as well as a few professional foresters, know exactly how to obtain the maximum growth and income from the hardwood forests found in the province. Professional foresters and owners have done a creditable job with the information now available to them, but both the cultural and economic aspects of woodland management need to be further explored and demonstrated.

Planting of tree seedlings for reforestation, erosion control, and wildlife food and cover has expanded rapidly in the past few years. Probably more than 150 million seedlings have been distributed for planting in the province by various state and federal nurseries since 1932. The largest single group of private purchasers of planting stock has been the strip mine operators. Large acreages of public forest lands and other lands suited to forest uses also have been planted.

Although there is some question concerning the best use of the 7,556,000 acres of marginal and submarginal agricultural land, particularly in the Prairie and Claypan Divisions, it is reasonable to expect that at least one-half of this area eventually will be forested. This is likely to be true for those lands on which forests will give the greatest returns to the owner. During the past several years we have learned much about forest planting. However, if regeneration is to occupy its proper position in land use in the province, we must learn more about the cultural and economic aspects of forest planting and plantation management.

Forest Industries

Table 3 shows for 1942 the number of active sawmills and the lumber production for the province and for the divisions. A total of 1,429 active mills was reported for the province. Since that time the number of active mills has probably increased about 20 percent. Approximately three-fourths of these sawmills have an annual production of less than 500 thousand board feet. The total lumber production for the province in 1942 was about 205 million board feet.

Table 3.--Number of active sawmills and lumber production, by province divisions, 1942 1/

Province Division:	Active Sawmills		Lumber Production	
	Number	Percent	MMBF	Percent
Prairie	366	26	29	14
Claypan	579	40	67	33
Bottomland	196	14	50	24
Upland	288	20	59	29
Total	1,429	100	205	100

1/ From U. S. Bureau of the Census

The Claypan Division had the largest number of sawmills and the largest production of the four province divisions. The Prairie Division had the second largest number of mills but the smallest total lumber production. Approximately 100 more active mills were reported in the Upland Division than in the Bottomland Division but these two divisions were about equal in volume of lumber produced.

Lumber production for the province is estimated to have increased 60 to 70 percent between 1942 and 1946. During this

same period the number of sawmills increased about five percent. This large increase in production with only a slight increase in the number of mills gives some indication of the production potential of the primary forest industry of the province.

In 1942, approximately 1,300 secondary wood-using industries were operating in the province. Probably many small rural concerns were not listed and undoubtedly many more have sprung up during the recent war years. Illinois ranked third among all states in 1939 manufacture of planing mills products and in wood furniture. The value of these products was estimated at 18 and 38 million dollars, respectively. The province has a 250 to 300 million dollar wood-using industry which requires about 3 billion board feet of raw material each year. More than nine-tenths of the total wood requirements must be imported. Even the demand for native species is not supplied within the province.

Although the secondary wood-using industry is chiefly concentrated in the Prairie Division, fairly good markets for lumber and other primary forest products exist in the other divisions. With the exception of low grade material most primary producers have little difficulty in disposing of their products. Undoubtedly the secondary industries could use several times the volume of lumber now produced in the province.

POTENTIAL ROLE OF FORESTS IN DIVISION ECONOMY

The rich agricultural and manufacturing area of northern Illinois has a fairly stable, self-sustaining economy. Forests cannot be expected to compete with agricultural crops nor can they be expected to contribute heavily to employment or industry in the Prairie Division. However, by properly managing the lands now in forests and by planting the potential forest lands, an even richer, more completely self-sustaining economy is possible.

In this division forests can probably make their greatest contribution by providing shelterbelts, wind breaks, erosion control and watershed protection. Products for home use, such as fence posts, fuel wood, and lumber, can be profitably grown on lands best suited to forestry. When given proper management and protection from fire and grazing, many of the small farm woodlots on areas unsuited to other uses should show a profit equal to or greater than any other land use.

An entirely different situation exists in the Claypan and Upland Divisions. Here coal mining and the oil drilling activities are concentrated, and soils are less productive. These divisions are not entirely self-sustaining now, and as the mineral sources are depleted socio-economic problems will multiply. Given proper management, the 2.9 million acres of forest land in these two divisions should provide sustained employment for many of the workers that will probably be unemployed when mining and drilling activities decline. Planting of the 4.7 million acres of marginal and submarginal agricultural land accompanied by proper management and harvesting practices should absorb many more workers.

The local development of small, secondary wood-using industries dependent upon forests of the area for raw materials will also increase employment opportunities within these divisions. When fully developed, these industries may provide more employment than afforded by woods work.

Thus, forests and dependent wood-using industries, if properly developed in these two divisions, can be expected to help fill the gap of unemployment and reduce subsequent socio-economic difficulties as the coal and oil fields are exhausted.

In the Bottomland Division forests can compete successfully with agricultural crops only on the poorer soils and the overflow lands. However, approximately 35 percent of the land area in this division is either now in forest or can be considered as a prospective addition to the forest area either through natural reforestation or planting. The fast growth rate of the bottomland forests makes them attractive for commercial operations. Development of a more extensive flood control system appears eminent in this division. Such a system will probably increase the area of overflow land, thus increasing the potential forest land acreage. Forest products may, then, become a more important crop in the Bottomland Division and may be expected to make a worthwhile contribution to its economy.

FORESTRY PROGRAMS OF OTHER AGENCIES

There are, within the province of the Carbondale Branch Station, several agencies; state, federal and private, which are engaged in forestry work and which have forestry programs. To avoid confusion of responsibilities and to illustrate the numerous opportunities for cooperative endeavor, these agencies are listed below. Their respective responsibilities and programs are briefly outlined. This list is based upon Illinois agencies and associations. Some of these have their respective

counterparts in the other states of the province. Wherever similar offices exist in the other states, their responsibilities follow the same general pattern as those in Illinois. The Carbondale Branch of the Central States Forest Experiment Station is responsible for developing a forest research program which is coordinated with the forestry programs of these other agencies and for carrying it to completion. In this manner duplication of effort will be avoided and the greatest possible contribution can be made.

STATE DIVISION OF FORESTRY

The State Division of Forestry in Illinois operates in four broad fields of forestry. The first three are jointly financed by the Illinois Department of Conservation and the United States Forest Service. The last activity is financed wholly from state funds. These activities are:

1. Farm forestry. Six farm forestry districts have been established in the more heavily timbered sections of the state. A technically trained forester is headquartered in each district. He gives on-the-ground assistance to timberland owners in managing their woodlands and in harvesting and marketing the products of their woodlands. He also gives assistance to primary and secondary wood-using industries within his district.

2. Growing and distributing tree seedlings. The State Division of Forestry operates two forest nurseries. It sells forest tree seedlings to land owners within the state at approximately production costs.

3. Fire protection. Approximately 2¼ million acres of forest land are given fire protection in organized districts. Nine fire towers are operated. Local fire wardens are designated, fire-tool caches provided, and fire crews organized to give fire protection on both state and private forest lands within the districts.

4. State forest administration. The State Division of Forestry protects and manages three state forests, totaling approximately 10,000 acres. These three forests are located in Henderson, Mason and Union Counties.

UNIVERSITY OF ILLINOIS

The Department of Forestry at the University of Illinois also has four principal fields of forestry work. Some of these are financed jointly by state and federal funds. Others are financed entirely by state funds. The Department activities are:

1. Farm forestry. Two farm forestry districts are supervised by the Department of Forestry. The responsibilities and activities of the foresters in charge of these districts are the same as those supervised by the State Division of Forestry.

2. Research. Forest management, regeneration, and wood utilization research is conducted by staff members of the Department. These activities are centered at the University, at Sinnissippi Farms in northwestern Illinois, and at Dixon Springs Experimental Farms in southeastern Illinois.

3. Extension work. The forestry extension staff attached to the Department cooperates with all farm foresters in the state and with the State Division of Forestry in planning and conducting demonstrations of woodland management, planting, woods work and woods equipment, utilization, and other phases of farm forestry activities. The forestry extension staff gives on-the-ground assistance to woodland owners, sawmill operators, and others outside the farm forestry districts. The staff also prepares publications on forest management, regeneration, utilization, and allied fields for distribution to farmers, 4-H Clubs, schools, and others interested in forestry.

4. Teaching. In addition to the above activities, some members of the Department conduct classes in forestry at the University.

SHAWNEE NATIONAL FOREST

The Shawnee National Forest manages about 200,000 acres of federally owned land in the extreme southern part of Illinois. It is the responsibility of the personnel attached to the Forest to administer these lands for the greatest good to the greatest number of the people. Management of these lands includes watershed protection, protection from fire, insects, and other destructive agents, management of the timber for sustained yield, development and maintenance of recreational areas, protection and propagation of wild life, planting of open lands,

and other associated work. These activities are for the most part confined to public lands in the Shawnee National Forest.

SOIL CONSERVATION SERVICE

Within the Soil Conservation Districts the Soil Conservation Service prepares farm plans for individual land owners. Cropping systems, farm management practices, and proper land use are considered in preparing each farm plan. Advice is given on the management of farm woodlands wherever they occur on farms for which plans are developed. Within the farm forestry districts the farm forester employed by the state and the farm planners of the Soil Conservation Service work together in developing management plans for farm woodlands.

ILLINOIS COAL STRIPPERS' ASSOCIATION

This organization is made up of Illinois companies who are mining coal by the open-pit method. The association employs a forester to assist and advise member companies in managing forests on spoil banks and adjacent holdings, and in establishing forest plantings on such lands.

ILLINOIS TECHNICAL FORESTRY ASSOCIATION

The Illinois Technical Forestry Association is an organization of professional foresters and others who are engaged in technical forestry work in Illinois. Public and private agencies, organizations, and industries are represented. The association was organized to coordinate forestry programs in the state, to distribute forest information within the state and to contribute generally to the advancement of forestry in Illinois.

FISH AND WILDLIFE SERVICE

Forestry activities of this federal agency center around planting and managing forest and other lands for production of wildlife food and protection. Planting of wildlife food and cover crops, including forest tree species, is conducted on private lands as well as on publicly owned game refuges, sanctuaries, and preserves.

ILLINOIS NATURAL HISTORY SURVEY

This state agency conducts research in forest management and planting as related to fish and wildlife management and production.

AMERICAN WALNUT MANUFACTURERS' ASSOCIATION

The American Walnut Manufacturers' Association is an organization of several walnut lumber- and veneer-producting companies in the central and eastern states. The association, as well as several member mills, employ trained foresters. Their forestry program consists of:

1. Promoting improved cutting practices among member mills.

2. Establishing and managing demonstration forests.

3. Distributing walnut seed to land owners. The association gathers the seed in large quantities and distributes it to the state forest nurseries. The seed is then prepared for planting and redistributed in smaller lots by the nurseries to land owners.

SINNISSIPPI FARMS

Sinnissippi Farms is a large privately owned estate near Oregon, Illinois. A part of the estate is devoted to forestry. A trained forester is employed to operate a sawmill, to supervise the planting of forest lands, and to manage the estate's forests.

COOK COUNTY FOREST PRESERVES

Approximately 40,000 acres of forest land, owned by Cook County, Illinois, are managed to provide recreational facilities to the residents of Chicago and surrounding communities. Several trained foresters are employed to manage and supervise these forest areas.

PRIORITY OF FOREST PROBLEMS

Listed below are the most pressing forest problems of the province considered as a whole--problems which must be solved to remove obstacles to progress in forestry. An effort has been made to distinguish between technical problems which can be attacked in this research program and other problems which must be solved largely or exclusively by cooperative research. In addition, we have endeavored to separate these problems into two priority groups.

PRIORITY I

Management of Fairly Well-stocked Existing Hardwood Stands

Perhaps the greatest need is for better information on how to handle such stands for maximum sustained production and financial return. This information is urgently needed for all important forest types and sites of the province. For example, what are the relative merits of even-aged and all-aged management? What is the best rotation for various forest types and sites? What cutting cycle? What intensity of management? How and when should we prune and thin? Are these treatments profitable? What is the optimum volume and diameter distribution at various ages?

These and many other questions must be answered before foresters will be able to recommend with assurance how a given stand should be managed to give the owner the greatest return. Both the biological and economic aspects of various cultural treatments and methods of management must be considered. The determination of the best methods of handling hardwood forests is a major technical problem, which can and should be solved by the research center, either directly or in cooperation with other interested agencies.

Rehabilitation of Understocked Stands

This is another pressing problem. Within the province are hundreds of thousands of acres of hardwood stands which have been seriously depleted by overcutting, grazing, and fire. What is the most efficient way to build up the growing stock and bring such stands into maximum sustained production? Will these stands yield a financial return while they are being rehabilitated? This, also, is an important technical problem which can and should be solved by research.

Criteria for Classifying Marginal and Submarginal Lands for Highest Use

The Soil Conservation Service and state agricultural experiment stations have done some very good work on the development of a basis for classifying rougher and poorer lands that are not suited to cultivation. However, there is still a real question as to whether some of these lands are better suited to forestry, grazing or other uses. Relatively good dataare available on the income to be expected from grazing, but here is little reliable information on the returns from such lands when planted to trees. No one knows for sure whether plantations would pay out on these lands or how the income from such plantations would compare with that from grazing or other uses. Forest research can and should provide the answer to this phase of the land-use classification problem.

Protection from Grazing

Forest grazing is a critical problem in this province. It is estimated that 54 percent of the woodlands are grazed, 23 percent so heavily that the stands are on the way out. Foresters already have a good basis for recommending against grazing of woodlots. The data on this subject might well be strengthened by additional observations on the effect of grazing upon reproduction, growth, and soil. However, the solution to this problem is largely the responsibility of the Farm Foresters and Extension Service. The greatest need is for an intensified program of information and education. The technical problems obstructing progress in this field have been largely solved.

Utilization

Investigations leading to new uses and markets for low-grade logs and billets and for woods and mill waste should be initiated in the province. Development of uses and markets for these products will increase income to the woodland owner.

An equally important corollary would be the early removal of culls and other low-quality trees from timber stands, thus increasing stand productivity. If these inferior materials and waste products can be harvested and delivered cheaply enough, marketing becomes less of a problem. Through the development of mechanized equipment increased efficiency should be possible. Improved methods and equipment for felling, bucking, skidding, loading and hauling should be explored,

developed, and demonstrated in the province. Also, improved methods and equipment for wood preservation, air-seasoning, and kiln-drying should be developed and demonstrated.

Plantation Management

Possibly 125,000 acres of plantations have been established in the province during the last quarter century. Many of these have reached or will soon reach the age when cultural measures should be applied. Information regarding the time and degree of thinning and pruning which will produce the greatest growth and return from these plantations is urgently needed. This is a job for research and well within the field of the Carbondale Branch Station. However, before undertaking such studies, the work previously completed or now under way at the University of Illinois and the Central States Station should be reviewed and the results correlated in order to prevent duplication.

Cull, Log Grades, and Grade Recovery

A fool-proof method of estimating cull in standing trees, such as has been developed in the South and the Lake States, is an indispensable tool for foresters. Good log grades and tree grades based upon recognizable characteristics and accompanied by grade yields are also essential tools. Before foresters and others can properly estimate the net volume and quality of standing trees these tools must be developed. Here again research has responsibility and, in cooperation with other agencies, should lead the way in solving these problems.

Reforestation

Although there is some question about the ultimate use of the 7,556,000 acres of land in the province that are classed as submarginal and marginal agricultural land, it is not unrealistic to believe that perhaps half of this area eventually will be planted. Past planting programs and current demands for planting stock substantiates this prediction. Therefore, regeneration research is an important problem in the province.

We should find the answers to:

1. What to plant where?

2. When to plant?

3. What are the best planting methods?

4. What species mixtures are best?

5. What is the best spacing?

6. What are the best seed sources?

7. On what sites and with what species will direct seeding equal or excel planted seedlings?

8. Will hybrid stock produce better plantations?

Of equal or even greater importance than the solution to the above problems is the determination of the returns from forest plantings as compared with other possible uses of planting sites.

A good start has been made already on some of the above problems and fairly conclusive results are available. Fragmentary information is available on others, and on still others no studies have been initiated. Before undertaking large scale investigations leading to the solution of these problems, studies now underway or completed will be reviewed to avoid needless duplication of effort.

PRIORITY II

Protection from Fire

Fire is not considered as critical a problem in this province as it is in the South and other sections of the country where it definitely stands in the way of progress in forestry. Moreover, it is a problem which must be solved largely through action programs of other agencies, such as the State Division of Forestry, which is primarily responsible for fire control. With extension of organized fire protection to all sections of the state, no doubt fire would cease to be even a second-priority problem. Further study and analysis may bring out technical problems, the solution of which would assist action agencies in making their fire-control programs more effective. If so, they deserve consideration in our research program.

Protection from Insects and Diseases

With the exception of tip moth and sawfly in coniferous

plantations on the Shawnee National Forest, no insects or disease infestations in the province are comparable to spruce bud worm in the Northeast, littleleaf disease in the Southeast, or white pine blister rust in sections of the country where white pine is an important commercial species. For this reason, protection from insects and diseases is assigned second priority. It should also be pointed out that research and action programs on insects and diseases are the responsibility of the Bureau of Entomology and Plant Quarantine and the Bureau of Plant Industry. Regardless of the seriousness of the problem, the work of Forest Service Research Centers in this field is strictly limited by law to cooperation on the silvicultural phases of insect and disease control.

Spoils Bank Rehabilitation

Within the province of the Carbondale Branch approximately 71,000 acres of land have been stripped for coal. Under present economic conditions and stripping methods, the acreage now stripped will probably not be more than doubled in future operations. Because the rehabilitation of spoils banks in Illinois and other central states is an important issue, the subject has been given wide publicity--some good and more bad. Regardless of publicity, the rehabilitation of these lands remains a real problem which can and should be attacked by forest research agencies.

Congress has appropriated special funds earmarked for use in solving the spoils bank problem in Illinois and other central states. Although this research in the province will be integrated with other work at the Carbondale Branch and will ordinarily be administered from Carbondale, research center funds need not be used for this activity. Therefore, spoils bank research need not be considered in determining priorities in the work center program. For completeness, however, the important points in this research program will be mentioned briefly. The early phases of this work have been directed toward two objectives:

1. Determination of the area stripped, and analysis of the chemical and physical characteristics of the banks as they affect plant growth. Natural and introduced vegetation found on the spoils will be analyzed and correlated with the chemical and physical condition of the banks.

2. Adaptation of tree species to spoils conditions.

Upon completion of these phases, it will be possible to divide the spoils into broad divisions, each having certain

similar qualities which influence the species and methods used in afforestation.

Some of the more important spoils bank regeneration problems which should be investigated are listed below:

1. Determination of the distinguishing characteristics of sites that are best suited to hardwoods and to conifers.

2. What materials contribute toxic acid to the banks and where are they located in the overburden?

3. Is it feasible to bury these toxic, acid-producing materials in the stripping operation?

4. What period is required for the toxic materials to leach out of the spoils so that planting is possible?

5. What size planting stock and species are most satisfactory for planting?

6. Will the seeding of some herbaceous plant, such as a legume, benefit planted tree seedlings?

The ultimate objective of research on these problems is to determine the most profitable method of growing and harvesting a forest crop from the spoils and adjacent abandoned lands.

Markets

Almost 90 percent of the forest area of the province are in small farm woodlands. Practically all of the buyers of primary forest products, such as logs and stumpage, are specialists who handle only one product. They are not ordinarily interested in individual trees or in purchasing small quantities of mixed products. For example, the cross-tie operator is only interested in tie stumpage. He commonly refuses to buy walnut trees and other speciality products found in the small farm woodland unless he can obtain them at tie stumpage prices. If the owner refuses to sell these individual trees for the price offered, he is left with either the entire woodland or with a few speciality trees representing too small a quantity to interest speciality buyers.

Thus, the small woodland owner frequently encounters difficulty in selling the products of his forest to his best advantage. To make markets available for small quantities of valuable products, common to farm woodlands, group marketing programs should be encouraged. Also, buyers should be encouraged to handle a variety of products in preference

to only one or two as they now do.

Although this is primarily an action program, research can and should contribute to its solution by compiling logging and transportation costs; determining and compiling data on timber volumes, forest acreage and growth, by species and sites; by developing commercial uses for local timber; by providing industries with all the facts they need to locate new plant sites and to expand existent wood-using plants.

Forest Land Valuation

The Carbondale Branch should assemble adequate data and develop suitable techniques for evaluating the productive capacity of woodlands, plantations, and potential forest lands. These data and techniques could be used to determine the value of timber lands, plantations, and potential forest land as collateral for loans. They could also be used in establishing equitable forest tax laws. Here again entire responsibility for assembling the data and developing the techniques may not fall within the field of forest research. However, research agencies should cooperate and assist wherever possible.

OTHER FACTORS CONSIDERED IN PLANNING RESEARCH PROGRAM

In the foregoing section an effort has been made to enumerate all problems which are considered serious obstacles to progress in forestry. Some, more critical than others, deserve high priority consideration, and have been so rated. Some in both priority classifications are primarily the responsibility of other agencies, or are not technical problems susceptible to solution by research alone. For these reasons they may be eliminated from further consideration in planning the research center program.

With present funds, manpower, and facilities, a start can probably be made on all first-priority problems within the next four or five years. This is our objective. If our program progresses as expected, it may also be possible to tackle some of the second-priority problems in the relatively near future. In the event the funds called for in the Forest Service's 5-year plan of research center expansion are appropriated by Congress, this program can be speeded up considerably. However, plans discussed in this analysis are based entirely on funds now available.

DIVISION PRIORITY

After the important forest problems of the entire work center province, comes consideration of divisional priority and emphasis. With our present organization we cannot attack even the most pressing problems simultaneously, and on the same scale, in all the divisions of the province. We must, then, narrow the field. Accordingly, the province divisions have been assigned priority on the basis of the following factors: extent and condition of present and prospective forest lands, present and anticipated land use trends, present and potential contribution of forestry to the local economy, socio-economic conditions, work of other agencies, and previous policy decisions and commitments.

A review of the situation in the Prairie Division indicates that little or no work is justified there except for co-operative studies with the University. The reasons are as follows:

1. There are about 1,389,000 acres of woodlands in this Division. An additional 1,932,000 acres has been classified as submarginal and marginal agricultural lands, It would be unrealistic to assume that in a free economy a large part of this latter acreage will be planted to trees in the foreseeable future. Regardless of proper land use, it is doubtful if there will be an increase in forest acreage in this Division for some time to come. Actually, this area is more likely to remain static or decrease.

2. Only six percent of the land area is now in forest.

3. The contribution of forests to divisional economy is now exceedingly small in comparison with the income from corn-hog agriculture and industry. Moreover, forestry will never play a major role in the economy of this rich agricultural section of the state. The soils are too valuable for other uses.

4. Excepting protection plantings and small woodlots to supply farm needs, forestry is economically justifiable only on the poorest and roughest lands of this Division.

5. With the farmers who own 98 percent of the woodlands, forestry is chiefly a side line. Farm forestry and similar programs can improve management practices in these woodlots. Even if research studies were to determine in detail the best silviculture to apply to farm forests, it is doubtful that the farm owners will become sufficiently interested or skilled

to practice intensive forestry. The acreage involved is too limited, and the income potential too small in comparison with corn and other crops.

6. Woodland owner practices are more likely to be extensive than intensive. For this type of forestry the application, general principles and techniques of management should suffice. These will be worked out in other divisions where forestry may be expected to contribute more to the local economy.

7. Some expansion of the research and action programs now carried on in this Division by the University, the Soil Conservation Service, and the State Division of Forestry seems desirable.

The situation is quite different in the Claypan Division. Here the problems and conditions seem to justify considerable research effort in the immediate future. The present forest area, 1,442,000 acres, is only slightly higher than the total for the Prairie Division, but the percentage of the total area in forests is significantly higher--13 percent as compared to six percent. The soils, especially those of the southern part, are much poorer than those in the Prairie Division.

The current trend is toward an increase in forest acreage, largely through abandonment of land for agriculture where soils are poor and topography is rough. Whether or not a substantial part of the 3,333,000 acres classified as marginal and submarginal agricultural land will be put to forest use remains to be seen. In view of the quality of the soil, local economic conditions, and the present land-use trend, it is probable that much of it will eventually revert to or be planted to forests. As foresters, we should not go overboard in encouraging this trend. We should first add to our present knowledge of how to establish successful plantations on these lands and of how the financial returns from such plantations compare with grazing and other uses.

Some large companies are showing interest in reforestation. This suggests the possibility of larger and more stable forest ownerships than at present. It also suggests more intensive forest practices than are expected in the small farm woodlots to the north.

In this Division, forestry now contributes proportionately more to the local economy than in the Prairie Division. With research to point the way and adequate extension to encourage better forestry practices, we may expect forests eventually to play a major role in the local economy.

The Bottomland Division has the smallest present and potential total forest acreage of any of the divisions. However, 17 percent of the area is in forest and the trend seems to be toward an increase in forest acreage. Because of rich soils, rapid growth of bottomland species, and the hazard of periodic flooding of agricultural crops, forestry is especially attractive on many of the sites of this Division.

Probably less is known about the management of bottomland species than any other forest type in the province. This is an important research job which must be considered. In deciding how much effort to devote to this Division, it should be kept in mind that the Forest Service maintains a bottomland hardwood research center at Stoneville, Mississippi. The entire program of this branch station is devoted to the study of bottomland forests. Local species and conditions are not identical with those of the Stoneville Research Center Province but many of the basic principles established there will apply to the bottomlands of our province. The Stoneville studies should not be duplicated locally. Instead only those techniques and practices which look most promising should be tested in this Division, with a view to adapting them to local conditions. By making full use of specialized research at Stoneville the effort expended in this Division should be reduced to a lower level than would otherwise be required to do justice to the problems of the bottomland hardwood forests.

Analysis indicates that the Upland Division rates top priority in regard to allocation of time and effort. The reasons are as follows:

1. The Kaskaskia Experimental Forest was purchased and developed in Civilian Conservation Corps days for the purpose of studying the forest problems of the Ozark Uplift section of southern Illinois and adjacent states. Little research has been conducted there for a number of years because of lack of funds. The research center appropriation now makes the reactivation of this unit possible. The lands, buildings, and other improvements represent an investment that would be difficult if not impossible to duplicate at this time in another location. Full use of this physical plant is therefore good policy.

2. When the research center funds first became available, July 1946, a meeting of interested parties was held in Harrisburg, Illinois. It was unanimously agreed at this meeting that the headquarters would be located in southern Illinois, preferably Carbondale. It was further agreed that the research program would be largely concentrated in, but not

limited to, the unglaciated sections of Illinois and adjacent states. Present at this meeting were State Forester Tomasek, Dr. Spaeth and Dr. Lorenz of the University of Illinois, Forest Supervisor Olson, Regional Forester Price, Ex-Director Stone and Director Mitchell, and others. Time did not permit a formal analysis preliminary to this meeting, but the decisions made at that time, based largely on familiarity with local conditions, are substantiated by the detailed data here summarized.

3. Approximately one-third of the total land area of this Division, 1,458,000 acres, is now in forest. The total forest area and percent of area in forest in the Upland Division is greater than in any of the other three divisions of the province.

4. Although the area of submarginal and marginal agricultural land in this Division is somewhat smaller than the area of similar lands in the Prairie and Claypan Divisions, it represents almost one-third of the total area of the Upland Division. Furthermore, the bulk of these lands will probably be planted or revert to forest in the foreseeable future.

5. The total area now in forest and expected to be put to this use eventually represents about two-thirds of the entire Division. Thus, forestry, forests, and dependent primary and secondary forest industries can and will make a major contribution to the economy of the Division. It is logical, then, that the research efforts of the Carbondale Branch be concentrated in the Upland Division.

All things considered, it is believed that, for probably the next ten years, our research effort should be divided about as follows: Prairie Division, none; Bottomland Division, 20 percent; Claypan Division, 30 percent; and Upland Division, 50 percent. In the initial period of organization, when much time and effort are required to get studies set up and under way, the greater part of our work, perhaps 75 percent or more, will be concentrated on first priority studies in the highest priority division. Once started, these studies will require only maintenance. It will then be possible to shift emphasis more in line with the eventual goals.

BALANCE BETWEEN LONG AND SHORT-TERM STUDIES

Timber crop often takes 80 to 100 years or longer to reach full maturity. Thus, certain long-term studies are absolutely

essential in forest research. On the other hand, much valuable information on the growth and development of forests can be obtained from short-term studies and observation of existing stands of various ages and conditions. In planning a research program for a unit such as this, there is always a danger of committing all or most of the available personnel to long-term studies. When changing conditions bring up unanticipated and often critical problems, the organization may be so committed to other work, that it is impossible to meet the new challenge. Ideally, there should be a reasonable balance between well-planned long-term studies and "quickies" which can be completed in a short period of time. This factor has been given serious consideration in planning the research program for this center.

RECOMMENDED RESEARCH, PLANNING, AND IMPROVEMENT PROGRAM FOR FISCAL YEAR 1948

The research and other projects to be undertaken in Fiscal Year 1948 are listed on pages 32 to 42. In the selection of studies, consideration was given to the various factors discussed above, with appropriate weights given to each. Emphasis has been given to the highest priority problems in the highest priority division of the province. To further implement organization and to assure getting first things first, work program priorities have been assigned within the division and forest problem priorities. Also, a reasonable balance between long and short-term studies has been achieved and provision has been made for the analysis, planning, and improvement work essential in the organization of a research center program.

In considering this work program for 1948, it should be kept in mind that some of the studies and jobs listed will be completed within the year and that others will require much less time once they are started and on a maintenance basis. Thus, it will be possible within another year or so to shift emphasis if changing conditions warrant, or to start other projects.

RESEARCH

PROVINCE DIVISION - Upland

FOREST PROBLEMS - Priority I

Work Program Priority I

A. Demonstrations on the Kaskaskia Experimental Forest.

1. Cutting Practices. Three areas of about five acres each have been designated in the Mixed Hardwood Type and three areas of about 1½ acres each have been designated in the Oak-Hickory Type for these demonstrations. One block in each type will be marked and cut according to good forestry practices, another according to moderate forestry practices (Forest Service Minimum Cutting Practice Rules--Region 9), and the third according to poor forestry practices. These demonstrations are of the "show window" type and will illustrate, by on-the-ground comparison, good, moderate, and poor marking and cutting practices in the two major forest types of the Upland Division.

   Assignment - Minckler and Fassnacht.

   Completion Date - (first cut) January 1948.

2. Species Adaptation to Site. Two rectangular blocks, each containing about 1¼ acres, were selected for planting on the Experimental Forest. One block was established on an average old-field site, the other on a poor, eroded old-field site. Four species of conifers and three species of hardwoods were planted in contiguous plots in each of the blocks. These demonstrations will provide easy, visual comparison of the growth and survival on two common planting sites of species usually recommended for planting in the Upland Division.

   Assignment - Minckler.

   Completion Date - April 1947.

3. Farm Woodland Management. A tract of about 25 acres of good hardwood timber has been selected to demonstrate the cultural and economic aspects of farm woodland management. This woodland will be managed intensively, using the best known forestry practices to obtain the highest possible sustained income.

   Assignment - Minckler and Fassnacht.

   Completion Date - (first cut) February 1948.

4. Rebuilding a Badly Deteriorated Farm Woodland.

A 25 acre tract of badly deteriorated, understocked hardwoods has been selected to illustrate the methods and economics of rebuilding this type of stand. The best known forestry practices will be applied to this tract in an effort to rebuild the stand to its maximum sustained producing level.

Assignment - Minckler and Fassnacht.

Completion Date - (first cut) February 1948.

5. Natural Area. A block of about 8 acres of excellent hardwood timber has been selected and set aside on the Experimental Forest as a natural area. This tract is fairly well stocked and its stand has a reasonably good distribution of tree diameters. However, many of the trees are over-mature, or are approaching maturity. Thus, it will serve to illustrate the mature hardwood forest as well as demonstrate the loss of growth and income resulting from holding timber beyond maturity.

Assignment - Minckler and Fassnacht.

Completion Date - Indefinite.

B. Formal Studies.

1. Optimum Stand Structure. The objectives of this observational study is to determine the kind of stand we should "shoot for" in managing the Mixed Hardwood and Oak-Hickory types of the Upland Division. Such factors as stocking, age, diameter distribution, and growth, will be measured on plots located in some of the best stands that we can find in each of the two forest types. From these data we will attempt to arrive at a stand structure which we think will give the optimum sustained return. This will then be our management objective. It is recognized that management goals established by this study will be temporary in nature but they will serve as a guide until we have arrived at a better objective through actual management of the stands on the Kaskaskia Experimental Forest.

Assignment - Working Plan: Minckler, Lane, Fassnacht.
Field Work: Minckler.

Completion Date - (field work) December 1947.

2. Gross Economic Life History. In this observational type of study we will attempt to determine the economic maturity of our more important species, as well as the volume and grade of products they will produce from the time they reach sawlog size to maturity. Such information will guide our selection of trees for cutting, in determining rotation and in various other phases of management work. As in the stand structure study, the results of this investigation will be temporary in nature. The real answer to this problem will be obtained from actual management carried out over a long period.

Assignment - Working Plan: Minckler, Lane, Fassnacht.
Field Work: Minckler, Lane.

Completion Date - (field work) December 1947.

3. Management of the Mixed Hardwood and Oak-Hickory Types on the Kaskaskia Experimental Forest. A part of the Experimental Forest has been divided into compartments averaging about 20 acres each. These will be used in studies of both the silvicultural and economic aspects of several management systems. Cost and return data obtained from areas of this size are more reliable than those obtained from small experimental plots. The management systems to be used in important forest types are shown below. The numbers in parentheses indicate the number of compartments to be assigned to a treatment.

a. Mixed Hardwood Type.
  Even-aged management.
    Two-cut shelterwood system.
      Long rotation, intensive management (3).
  Uneven-aged management.
    Short rotation.
      Short cutting cycle, intensive management (3).
      Long cutting cycle, intensive management (3).
    Long rotation.
      Short cutting cycle.
        Extensive management (3).
        Intensive management (3).
      Long cutting cycle, intensive management (3).

b. Oak Hickory Type.
Even-aged management.
Short rotation, commercial clear cut.
Extensive management (2).
Intensive management with interplanting (2).
Uneven-aged management.
Long rotation.
Short cutting cycle.
Intensive management (2).
Intensive management with interplanting (2)
Long cutting cycle.
Intensive management (2).
Intensive management with interplanting (2).
Short rotation.
Short cutting cycle, intensive management (2).
Long cutting cycle, extensive management (2).

Assignment - Minckler, Fassnacht, Train, Lane.

Completion Date - (compartment lay-out) March 1948.

4. Forest Management Unit. A 400-acre block of timber on the Experimental Forest has been selected for management. This will be the final testing ground for the results of plot and compartment studies. The following three objectives will be recognized in the management of this unit.

a. To learn how to make a forest management plan.

b. To determine the costs and returns from managing a relatively large block of hardwood timber.

c. To learn how to apply to a going forest the desirable practices resulting from plot and compartment studies.

Assignment - Fassnacht, Train, Minckler, Lane.

Completion Date - (management plan) July 1948.

5. Growth on the Kaskaskia Experiment Forest. The objective of this study is to determine the present volume growth on the Experimental Forest.

These results will serve as a reference point for comparing growth before and after management, and as a partial basis for establishing the allowable cut, length of cutting cycle, and rotation for the previously outlined management studies. The information obtained in this study will be taken on sample plots.

Assignment - Minckler, Fassnacht, Train.

Completion Date - December 1947.

6. Maintenance or Completion of Earlier Studies. Four of the studies initiated on the Kaskaskia Experimental Forest prior to establishment of the Carbondale Branch are now ready for final measurements or progress reports. They are:

a. Pruning of Shortleaf and Pitch Pine.

b. Effect of ground cover on growth and survival of planted hardwood seedlings.

c. Shipmast vs. common black locust.

d. Types of tree defects and associated cull.

These studies will be reviewed and brought up to date. Formal releases will be made where warranted. Those plots which lend themselves to demonstrations will be maintained and explanatory signs erected.

Assignment - Chapman, Lane, Minckler, Fassnacht, Train.

Completion Date - June 1948.

Work Program Priority II.

A. Formal Studies.

1. Forest Service Minimum Cutting Practice Rules. A few years ago Forest Service officers in Region 9 developed a set of cutting practice rules they believed would, if followed, provide moderate minimum forest practices. One compartment of about 20 acres in the Mixed Hardwood Type and another of similar size in the

Oak-Hickory Type will be cut according to the rules they developed. This will provide a test of the minimum cutting practices now set up for the Mixed Hardwood and Oak-Hickory Types.

Assignment - Minckler, Fassnacht.

Completion Date - (compartment lay-out) February 1948.

2. Species Adaptation to Site. The objectives of this study is to determine what species are best for planting on several of the import sites.

Assignment - Minckler.

Completion Date - (establishment) Indefinite.

3. Direct Seeding of Pine and Red Cedar, Hand and Machine Methods. Success of pine and red cedar plantations established by direct seeding will be compared with similar plantations established by planting seedlings of these species. Both hand and machine methods will be used in planting pine and cedar seeds.

Assignment - Minckler.

Completion Date - (establishment) May 1948.

4. Fall vs. Spring Planting. The growth and survival of plantations established in the fall will be compared with spring plantations. If plantations can be successfully established by fall planting, the spring work load at the nursery and in the forest can be reduced, making possible an expanded planting program with a given nursery and planting force.

Assignment - Minckler.

Completion Date (establishment) - April 1948.

5. Seed Source of Pine and Pine Hybrids. Studies in the South and elsewhere have indicated that seed source has a significant bearing upon the growth and survival of tree seedlings. Also, several pine hybrids have been developed which may be superior to standard planting stock. Several seed sources for shortleaf and loblolly pine and red cedar, as well as several of the pine hybrids, will be tested in the Upland Divisions.

Assignment - Minckler.

Completion Date - (establishment) Indefinite.

6. Interplanting of Oak-Hickory Stands with Pine and Red Cedar. By interplanting the poorer oak-hickory forests it may be possible to increase the yield of these stands. However, before studying the economics of interplanting, we should learn more about the silvicultural aspects of the problem. The objectives of this invesitgation are to learn when to release and the intensity of release required to give the best growth and survival of interplanted seedlings.

Assignment - Minckler.

Completion Date - (establishment) May 1948.

Studies 2, 3, 4 and 5 will be conducted on small experimental plots.

PROVINCE DIVISION - All Divisions

FOREST PROBLEMS - Priority II

Work Program Priority I.

A. Formal Studies.

1. Cumulative Volume Tally Sheets. Farm Foresters and others throughout Illinois are now using the cumulative volume tally sheets developed by the Lake States Forest Experiment Station. There is considerable evidence that these sheets should be revised to fit local conditions. The Carbondale Branch in cooperation with Illinois Technical Forestry Association will attempt to find out what corrections are needed to give more accurate volumes and how these corrections can be applied.

Assignment - Lane, Schnur.

Completion Date - April 1948.

2. Spoils Bank Reconnaissance. During the past several months the stripped lands in Illinois have been surveyed for extent of stripping,

chemical and physical characteristics of the spoils, and the nature and condition of natural and introduced vegetation found on the banks. During the next year this work will be conducted in Indiana.

Assignment - Auten.

Completion Date - Indefinite.

3. Adaptation of Tree Species to Spoils Conditions. Several species of tree seedlings were planted on several different types of spoils in Illinois and Indiana during the spring of 1947. Initial growth and survival measurements will be made on these plots during the winter of 1947 and again in 1948. Additional maintenance work may also be required.

Assignment - Limstrom.

Completion Date - Indefinite.

Planning and Improvement

Work Program Priority I.

A. Work Center Organization.

1. Assembly of Staff and Delegation of Responsibilities, Equipment Procurement, Location of Quarters, Storage and Other Organizational Functions.

Assignment - Lane.

Completion Date - Indefinite.

2. Program Conference to Discuss Overall Objectives and Research Program.

Assignment - Lane

Completion Date - May 1947.

3. Preparation of Program Analysis for the Province.

Assignment - Lane

Completion Date - September 1947.

4. Forming Advisory Committee and Conducting Meeting of Committee.

Assignment - Lane.

Completion Date - October 1947.

5. Negotiating Cooperative Agreements with State, Federal and Private Agencies and Associations Within the Province.

Assignment - Lane.

Completion Date - Indefinite.

6. Investigating Sources of Land for Experimental Purposes in the Bottomland and Claypan Divisions.

Assignment - Lane.

Completion Date - July 1948.

B. Operation of the Kaskaskia Experimental Forest.

1. Improvements of Living Quarters and Buildings.

Assignment - Fassnacht, Train, Lane.

Completion Date - Indefinite.

2. Survey of Experimental Forest Boundaries, Marking of Boundaries, Establishment of Interior Base Lines for Compartment and Plot Ties, Preparation of Base Maps.

Assignment - Fassnacht, Train.

Completion Date - October 1947.

3. Development of Road System Plan.

Assignment - Fassnacht, Lane.

Completion Date - April 1947.

4. Investigation of Acquisition Possibilities Within Experimental Forest Boundaries.

Assignment - Fassnacht, Lane.

Completion Date - Indefinite.

5. Preparation and Installation of Sign System.

Assignment - Fassnacht, Lane.

Completion Date - May 1948.

6. Preparation of Record System.

Assignment - Lane, Fassnacht, Minckler, Train.

Completion Date - January 1948.

7. Preparation of Publication Describing Briefly the Experimental Forest and the Work in Progress.

Assignment - Lane, Minckler, Fassnacht, Train.

Completion Date - March 1948.

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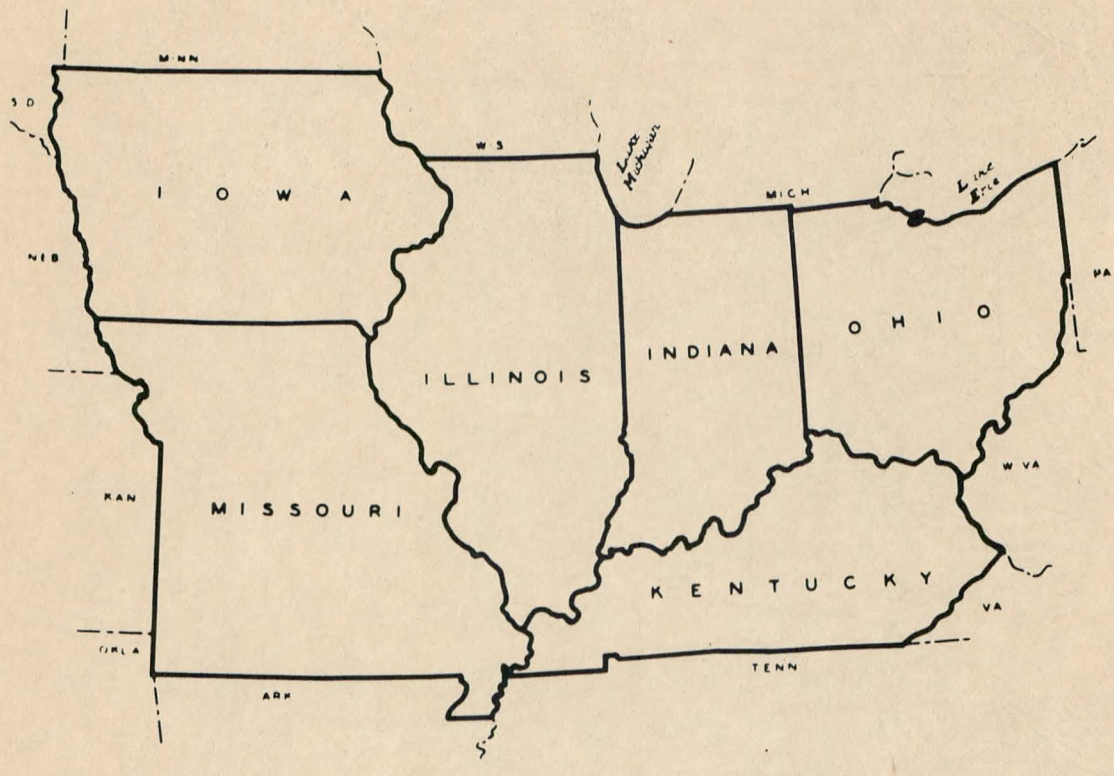

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